NON-PUBLIC?: N
ACCESSION #: 9512290387
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Diablo Canyon Unit 1 PAGE: 1 OF 6

DOCKET NUMBER: 05000275

TITLE: Manual Reactor Trip Due to Loss of Feedwater Due to
Design Deficiency
EVENT DATE: 11/28/95 LER #: 95-015-00 REPORT DATE: 12/22/95

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 50

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Donald H. Behnke, Senior Regulatory
Services Engineer TELEPHONE: (805) 545-2629

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: JK COMPONENT: SC MANUFACTURER: L253
REPORTABLE NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On November 28, 1995, at 2215 PST, with Unit 1 in Mode 1 (Power Operation) at approximately 50 percent power, plant operators initiated a manual Unit 1 reactor trip. The trip was initiated when feedwater flow was lost. The in-service main feedwater pump (MFP) had tripped on high discharge pressure. Unit 1 was stabilized in Mode 3 (Hot Standby) in accordance with emergency operating procedures. A 4-hour non-emergency report was made to the NRC on November 29, 1995, at 0035 PST, in accordance with 10 CFR 50.72(b)(2)(ii).

PG&E determined the root cause to be a design deficiency in the speed probe cabling for the MFP speed controller that resulted in the signal wire grounding inside the conduit coupling. PG&E determined a contributing cause to be the maintenance practice of storing the excess wire for the probe inside the conduit near the coupling.

Corrective actions included replacing the failed speed probe and inspecting the remaining speed probes on both Unit 1 and Unit 2 main feedwater pumps. PG&E will design and install connectors for the speed probes to facilitate maintenance. PG&E is reviewing this event with maintenance personnel through group meetings and will include the event in the next quarterly maintenan
e training program.

LER. TPL

END OF ABSTRACT

I. Plant Conditions

Unit 1 was in Mode 1 (Power Operation) at 50 percent power.

II. Description of Problem

A. Summary:

On November 28, 1995, at 2215 PST, with Unit 1 in Mode 1 (Power Operation) at approximately 50 percent power, the single main feedwater pump (SJ)(P)(MFP) in service tripped on high discharge pressure. When feedwater flow was lost plant operators initiated a manual Unit 1 reactor trip and stabilized the plant in Mode 3 (Hot Standby) in accordance with emergency operating procedures. A 4-hour non-emergency report was made to the NRC on November 29, 1995, at 0035 PST, in accordance with 10 CFR 50.57(b)(2)(ii).

B. Background:

The plant has two steam driven MFPs, each capable of providing approximately 50 percent of full power feedwater flow. At the time of the event, MFP 1-2 was in service and MFP 1-1 was out of service for maintenance.

The MFP controllers use two speed probes (SC)(JK)(YM-1509) designated alpha and beta. The alpha probe is normally in service. The speed controller shifts to the beta probe if the alpha probe fails. The speed probes are mounted in a bearing cap in proximity to a toothed wheel mounted on the shaft. A speed probe output signal consists of a low voltage DC signal

(approximately 5 volts) that has superimposed upon it a sinusoidal signal generated by the movement of the toothed wheel past the probe. The sinusoidal signal oscillates at a frequency proportional to the speed of the pump shaft. The controller detects probe failure by an open circuit in any of the probe leads.

During operation, the MFP controller compares the signal from the speed probe with the demand signal from the digital feedwater control system to generate a signal that controls the valve position of the steam supply valves for the MFP turbine.

PG&E installed the speed probes as part of an upgrade to the MFP controls during the Unit 1 and Unit 2 first refueling outages in 1986 and 1987, respectively. The probes have been removed and reinstalled several times

because they must be removed each time the pump bearing cap is removed for maintenance.

There are no connectors for disconnecting the speed probe wires. The speed probes are installed on the bearing cap by means of a threaded connection. The three lead wires (small gauge Teflon insulated) from the probe are routed through a 90 degree elbow then through a flexible conduit that is connected by a threaded coupling to the elbow. The probe wires go through the flexible conduit to a junction box 3 to 4 feet away. At the junction box the lead wires are soldered to the wires that go the speed controller.

To remove a speed probe, the technician disconnects the flexible conduit coupling at the probe elbow. The technician then extracts sufficient excess wire from the conduit to allow the probe to be unscrewed from the bearing cap. The probe is bagged, labeled, and left in place at the MFP.

To reinstall the probe, the technician pre-twists the probe wires by the number of turns estimated to be required to thread the probe into the bearing cap, and then screws the probe into place. The technician then coils up the excess wire and inserts it into the flexible conduit, then reconnects the conduit to the elbow. There are no written instructions for

this process, and past practice has been to rely on the skill of the craft for proper installation.

C. Event Description:

On November 28, 1995, at 2215 PST, with Unit 1 in Mode 1 (Power Operation) at approximately 50 percent power during power ascension following a refueling outage, the single MFP in service tripped on high discharge pressure. Plant operators initiated a manual Unit 1 reactor trip when feedwater flow was lost.

Investigation into the MFP trip revealed the alpha speed probe had a pinched signal wire inside the conduit connector at the probe causing it to be grounded. The signal wire was still able to send the 5 volt DC signal to the controller, but the ground reduced the superimposed sinusoidal signal to a small ripple that the controller could not detect. The resultant signal appeared to the controller to be a good signal from a stationary pump (no shaft rotation).

When the controller sensed zero speed, it increased the steam supply valve opening, which caused the high discharge pressure condition that tripped the pump.

Following completion of MFP maintenance during the outage, maintenance

personnel had satisfactorily tested the operation of the speed probes. PG&E believes the signal wire did not immediately make contact with the connector, but over time the Teflon coating on the wire relaxed sufficiently to allow the bare wire to contact the metal connector. Maintenance personnel were able to reproduce the effect of grounding the signal wire on controller operation in the field.

PG&E also inspected the beta probe on MFP 1-2, and the probes on the MFPs 1-1, 2-1, and 2-2. The beta probe on MFP 1-1 had nicked wires and that probe was replaced. The alpha probe on MFP 2-1 had one wire that had insulation damage and was taped. The alpha probe on MFP 2-2 had wires covered with self vulcanizing tape.

D. Inoperable Structures, Components, or Systems that Contributed to the Event:

None.

E. Dates and Approximate Times for Major Occurrences:

1. November 28, 1995, at 2215 PST Event Date/Discovery Date:
Unit 1 was manually
tripped due to loss of
MFP 1-2.

2. November 29, 1995, at 0035 PST PG&E made a 4-hour non-emergency report to
the NRC in accordance
with 10 CFR
50.72(b)(2)(ii).

F. Other Systems or Secondary Functions Affected:

None.

G. Method of Discovery:

The event was immediately apparent to plant operators due to alarms and indications received in the control room.

H. Operator Actions:

Licensed plant operators in the control room responded in accordance with established emergency procedures. They confirmed the reactor trip, verified

proper engineered safety feature actuations, and initiated manual actions to stabilize the unit in Mode 3.

I. Safety System Responses:

1. The reactor trip breakers (AA)(BKR) opened.

2. The main turbine (TA)(TRB) and generator (TB)(GEN) tripped.

3. The control rod drive mechanisms (AA)(DRIV) allowed the control rods to drop into the core.

4. Both motor driven auxiliary feedwater (AFW) pumps (BA)(P) started due to the loss of feedwater.

5. Diesel generator 1-1 (EK)(DG) started on momentary bus undervoltage due to light bus loading conditions, but by design did not close onto its 4 kV bus since startup power was available.

6. All five containment fan coolers (EK)(FAN) started at their selected speed.

III. Cause of the Problem

A. Immediate Cause:

The immediate cause of the loss of MFP 1-2 was grounding of the speed probe signal wire that caused a zero speed signal to be input to the speed controller. The speed controller increased the opening of the steam supply valves to the MFP turbine, and the MFP tripped on high discharge pressure.

B. Root Cause:

The root cause was a design deficiency with the MFP speed probe wiring in that it does not facilitate the routine removal and reinstallation of the speed probes. The design requires excess wire to be stored in the conduit to allow sufficient slack for removal and reinstallation of the probes. This excess wire is located in the vicinity of the threaded conduit coupling and presents an opportunity for the wires to become pinched.

C. Contributing Cause

A contributing cause was the maintenance practice of storing the excess wire inside the conduit near the coupling. It has been common practice for technicians to coil and store the

excess wire in this manner. The disposition of slack wires is considered skill of the craft. Placing the excess wires near the coupling presents a risk for them to become nicked or pinched.

IV. Analysis of the Event

The loss of normal feedwater is a previously analyzed Condition II event. Per design, the automatic start of the two motor-driven AFW pumps ensured the adequate supply of water to the steam generators to provide for the cooldown of the reactor. Therefore, the health and safety of the public were not adversely affected by this event.

V. Corrective Actions

A. Immediate Corrective Actions:

PG&E replaced the failed speed probe and inspected the remaining speed probes on Unit 1 MFPs. PG&E inspected the Unit 2 speed probes during a plant shutdown on December 13, 1995.

B. Corrective Actions to Prevent Recurrence:

1. PG&E will design and install speed probe cable connectors to simplify speed probe removal.

2. PG&E is reviewing this event with maintenance personnel through group meetings and will include this event in the next quarterly maintenance training program.

VI. Additional Information

A. Failed Components: None.

B. Previous LERs on Similar Problems: None.

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December 22, 1995

PG&E Letter DCL-95-278

PG&E

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Docket No. 50-275, OL-DPR-80
Diablo Canyon Unit 1
Licensee Event Report 1-95-015-00
Manual Reactor Trip Due to Loss of Feedwater Due to Design Deficiency

Gentlemen:

Pursuant to 10 CFR 50.73(a)(2)(iv), PG&E is submitting the enclosed Licensee Event Report concerning a manual reactor trip due to loss of feedwater due to design deficiency. This event did not adversely affect the health and safety of the public.

Sincerely,

Gregory M. Rueger

cc: Steven D. Bloom
L.J. Callan
Jennifer Dixon - Herrity
Kenneth E. Perkins
Michael D. Tschiltz
Diablo Distribution
INPO

Enclosure

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